LINEAGE POWER

Galaxy Power System Verification Procedures

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Notice:
The information, specifications, and procedures in this manual are subject to change without notice. Lineage Power assumes no responsibility for any errors that may appear in this document.

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1 Introduction

Overview

This manual provides general verification procedures for inspection and testing of Lineage Power Galaxy Power System (GPS) products. The test procedures mentioned in this manual correspond to controller software version 6.5.

The Lucent GPS family of products is designed to operate maintenance-free, without the need for any regular adjustments or fine tuning. The output voltage and current limit are set by the controller, and the information is sent as a broadcast message to all rectifiers. All the rectifier outputs will be automatically adjusted to this level; no individual rectifier level voltage adjustment is required.

If, however, the customer requires any kind of routine verification or inspection (even though Lineage Power does not recommend it), the techniques described in this manual may be used as guidelines to test all the alarms.

The tests described here will simulate various alarm conditions and verify that the controller functions properly.

The fans used in the 595-Series and 596-Series rectifiers have a typical lifetime of 7 years. The fans in the 597A and 597B 24V/48V converter carriers have a typical lifetime of 4 to 5 years. Lucent recommends that these fans be replaced at these intervals as described in Section 4, *Replacement Procedures* in this manual.

Note: Fan assemblies should be kept dust-free at all times. Air flow through the rectifiers is important for the proper operation of the rectifiers.

2 Galaxy SC Controller Performance Verification Procedures

Introduction

The procedures in this section may be used to test the different alarms in a live Galaxy SC Controller system. The procedures are the same for both rear access and front access Galaxy SC controllers.

Tools

The following tools are required to complete the tests described in this section:

- Digital Voltmeter (DVM) with dc accuracy of at least 0.05%
- Short length of wire or clip lead for jumper
- Jeweler's screwdriver

Precautions

Before performing the test procedures, verify that the following conditions exist:

- All rectifiers are functioning properly.
- Plant batteries are fully charged and are ready to support a load. (See Caution below.)

  Caution: When Alarm Tests are performed on a live plant, some of the tests will cause a battery discharge to occur. In this case, ensure that the plant batteries are capable of supporting the load. It is recommended that a battery discharge test be performed before proceeding with other tests.

Follow the steps of the procedures in the order they are given.

Illustrations

Refer to Figures 2-1 and 2-2 for illustrations of the Galaxy SC Controller.

SC Controller

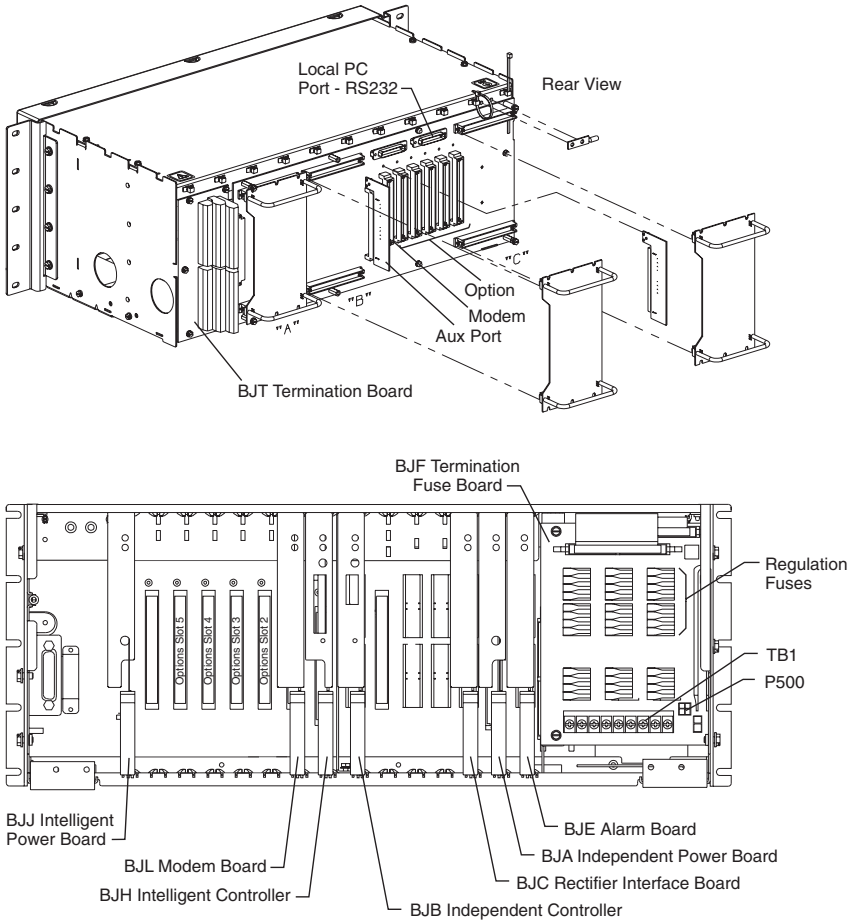
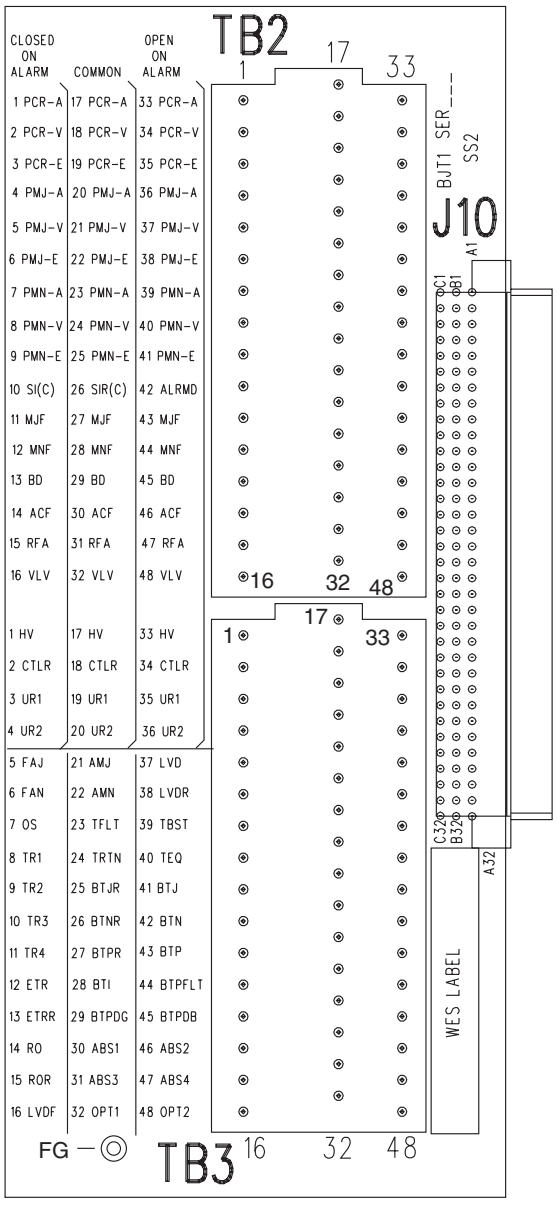


Figure 2-1: Location of Galaxy SC Controller Circuit Boards

Illustrations, continued



BJT Board
(Galaxy SC Controller)

Figure 2-2: TB2 and TB3 of Galaxy SC Controller

Illustrations, continued

SCF Controller Figures 2-3 and 2-4 are illustrations of the Galaxy SCF Controller.

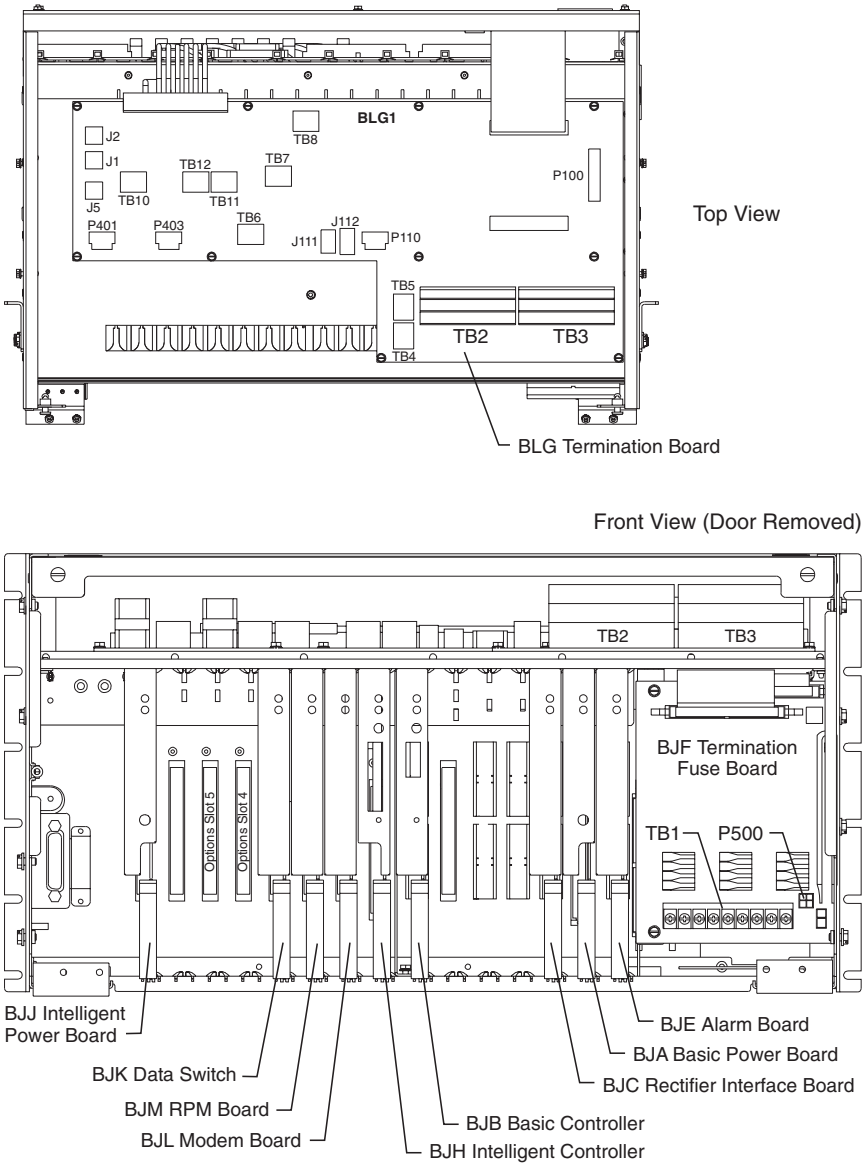
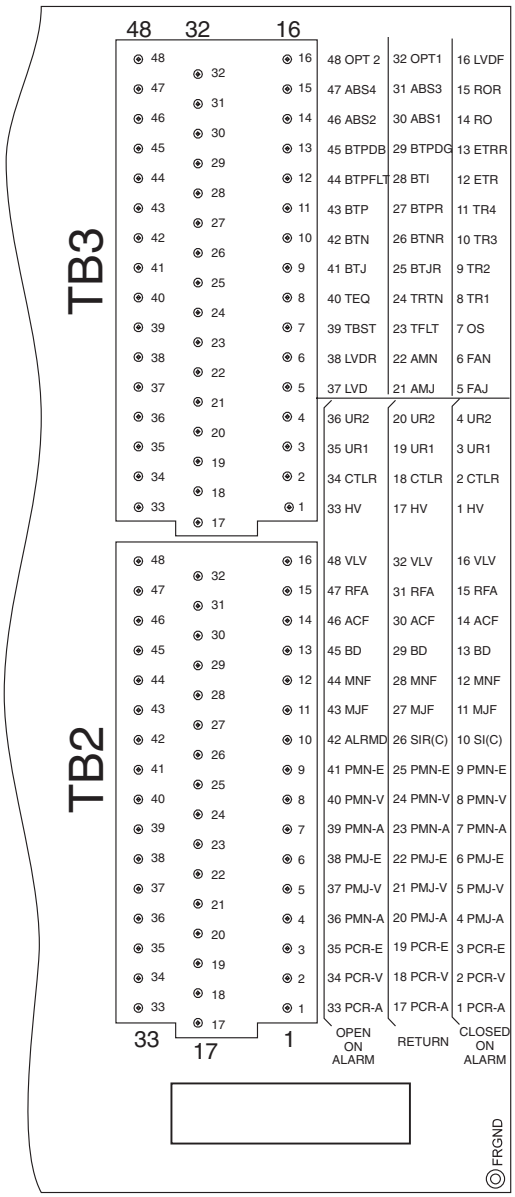


Figure 2-3: Location of Galaxy SCF Controller Circuit Boards

Illustrations, continued



Part of BLG Board
(Galaxy SCF Controller)

Figure 2-4: TB2 and TB3 of Galaxy SCF Controller

Lamp Test

Depress the <LAMP TEST> key on the controller's front display interface. All LEDs on the controller front panel, controller boards, and Lucent serial rectifiers will turn on momentarily and then retire.

Alarm Test

Introduction

Alarm Test provides a method of testing the operation of all or any of the plant alarm relays and their wiring to the connected alarm system. This test cannot be done if any alarms are active. It may also be desirable to perform this test occasionally after the plant is in service to verify the integrity of the office alarms for the power plant.

Alarm Test may be performed locally or from a remote terminal.

The Alarm Test feature will, in succession, operate each of the controller alarm relays. With the basic controller, the default duration is one minute. With the intelligent option for the controller, the selection of the relays to be operated and default duration can be changed using the EasyView interface.

Local Alarm Test

Refer to Figures 2-1 and 2-2 for the SC Controller, and to Figures 2-3 and 2-4 for the SCF Controller.

SW202-5 on the BJB Basic Control Board must be enabled along with its associated software switch found on the front panel under the path: MAIN → CONFIG → ALARM → TEST ALM.

If HVSD is desired during the test, BJB SW202-4 must also be enabled, along with the appropriate software switch found on the front panel under the path: MAIN → CONFIG → ALARM → TEST HV. Each rectifier in the plant must have a load of at least 10% of its capacity.

When configured with the optional intelligent controller, the alarm conditions tested during Alarm Test and their duration may be specified within EasyView with the path: MAIN → CONFIGURE → ALARM TEST. As an alternative to the front panel configuration of the Alarm Test software switch, it may be also configured within EasyView under the path: CONFIGURE → DC PLANT → HARDWARE & SOFTWARE CONFIGURED.

Note: **Front panel LEDs do not activate during the alarm test**. The alarm relays whose contacts are accessed on TB2 and TB3 (BJT board on rear of SC controller/BLG on top section of the SCF controller) may be monitored to follow the progress of alarm testing.

Alarm Test, continued

Local Alarm Test, continued

The Alarm Test will operate, in sequence, each of the relays shown below for a default interval of approximately 60 seconds. This interval for each relay's activation during this test may optionally be set in an intelligent controller via EasyView path: MAIN → CONFIGURE → ALARM TEST.

Initiate Alarm Test locally by momentarily pressing the Alarm Test switch recessed into the front of the BJB basic controller or press the <MENU> key to bring up the MAIN screen and follow the path: MAINT OPER → ALARM TEST. The ALM TEST STAT field of this same screen can then be used to follow the progress of the Alarm Test.

The progress of the activated relays can be followed during the test by going straight down the TB2 and TB3 terminal blocks if the connected alarm system is not yet processing. (See Figure 2-2 for the SC, Figure 2-4 for the SCF.) The progress of relay activation may also be monitored in the ALM TST STAT field of the MEASURE/STATIS screen of an Intelligent controller or the MAIN screen in the basic controller.

Rectifier Fail Alarm Test - RFAT*
Power Critical - PCR
Power Major - PMJ
Power Minor - PMN
Major Fuse - MJF
Minor Fuse - MNF
Battery on Discharge - BD
AC Fail - ACF
Rectifier Fail Alarm - RFA
Very Low Voltage - VLV/UR3**
High Voltage - HV
Controller - CTLR
User Relay 1 - UR1**
User Relay 2 - UR2**

*RFAT is an alarm test intended for use with non-serial type rectifiers that are connected to the “Enhanced Ferro” RIM (J85501F-1 L32) of an SC controller ONLY.

**UR1, UR2, and UR3 are inhibited if LVD Contactors have been configured and a Bay Interface Card is not configured in the system.

Note: If the controller has an earlier version of software (<6.0), VLV is used instead of UR3.

Alarm Test, continued

Remote Alarm Test

Using EasyView to perform the Alarm Test, hardware switches SW202-5 on the BJB board and SW204-2 on the BJH board must first be enabled, in addition to the software switches located at menu path.

EasyView: CONFIGURE → DC PLANT → HARDWARE AND SOFTWARE CONFIGURED

Both the Alarm Test and Remote Alarm Test fields must be enabled.

Initiate the test remotely with the EasyView path:
CONTROL → ALARM TEST.

Follow the status of the test remotely with the EasyView path:
STATUS → ALARM TEST.

High Float Voltage Alarm/High Voltage Shutdown Alarm Tests

Overview

The High Float Voltage Alarm Test differs depending on whether the system uses parallel or serial rectifiers. Both are described in this section.

The HV test can be done by either raising the plant voltage above the threshold set for HFV (High Float Voltage) and HVSD (High Voltage Shutdown) or by lowering the thresholds for these conditions to make them active.

Note: HFV is an alarm-only that can notify users of an impending HV condition before the need for a shutdown arises.

Preparations

Note the value of plant voltage from the Default screen. Use the following table to record settings before beginning the test procedures for both parallel and serial rectifiers:

Plant Nominal Float Voltage	HV	HFV

High Float Voltage Alarm/High Voltage Shutdown Alarm Tests, continued

HV/HVSD Test Procedure for Parallel Rectifiers

Do not raise the plant bus voltage if an active load is being served. To test HVSD under this situation, ensure that sufficient battery reserve is connected to the plant bus to support the plant load. The battery may start sharing some load and BD alarms may turn on during this test.

Step	Action
1	Disable Load Share on the rectifiers (if equipped) and adjust the rectifier voltages until each is delivering at least 10% of its capacity. Turn Off unneeded rectifiers if necessary to accomplish this.
2	From the Front Display interface, use the path: MAIN → CONFIG → THRESH and lower the HFV/Float level to 1 volt below the current float voltage. Verify that the Power Minor relay has activated and the RECT and Minor LEDs are active.
3	Next, use the path: MAIN → CONFIG → THRESH and lower the HV/Float level to 1 volt below the current float voltage. This should activate HVSD, turning Off all plant rectifiers and placing the plant into a BD (Battery on Discharge) condition. The BD, RECT, and Major LEDs should all activate, along with the Power Major, BD, and RFA alarm relays. After 5 seconds, all rectifiers will restart and, following walk-in, will begin raising the plant back to float. When the voltage passes the new HV threshold again, HVSD will occur again and all rectifiers will remain locked Off.
4	Use the path: MAIN → CONFIG → THRESH one final time to reset the HFV and HV Float levels to their desired normal settings (refer to table where initial settings have been recorded) and then the path: MAIN → RECT RST to restart all plant rectifiers, retiring the BD and RECT alarms.
5	Repeat the test for any rectifiers that were turned Off to achieve the 10% minimum load capacity level of each rectifier. After all rectifiers have been tested, adjust each to plant float, if necessary, and reenable Load Share on the rectifiers, if equipped.

High Float Voltage Alarm/High Voltage Shutdown Alarm Tests, continued)

HFV Test Procedure for Serial Rectifiers

Raising the plant voltage on a working system is left to the discretion of the user. This test could disrupt power to working equipment. If the test is performed, verify that the plant is in FLOAT mode and that rectifier voltage has been set to the normal level after completing the test.

Tests must be done with batteries connected, or else when the rectifiers shut down, the controller will also shut down.

Step	Action
1	From the front panel, follow the path <MENU> → CONFIG → THRESH → HFV (FLOAT). Use the <Adjust> keys to change the value of the HFV threshold to a level below the plant voltage noted above. Press <ENTER> to save the change.
2	Observe that the controller initiates a Power Minor alarm (PMN) and illuminates the RECT and MIN LEDs.
3	Follow the path <MENU> → CONFIG → THRESH → HFV (FLOAT) and restore the threshold to it's original setting. Press <ENTER> to save the change.

High Float Voltage Alarm/High Voltage Shutdown Alarm Tests, continued))

HVSD Test Procedure for Serial Rectifiers

There are three requirements for a serial rectifier to shut down upon a controller-initiated High Voltage Alarm:

- The plant voltage must be above the level set for HV at the front panel path: <MENU> → CONFIG → THRESH.
- The rectifier must be delivering a current exceeding 10% of it's capacity.
- The rectifier's current output must be unbalanced by more than 10% from the average output currents of the other rectifiers. Because this is difficult to achieve in a simulation test of properly functioning serial rectifiers, even with load share disabled, rectifiers are tested one at a time rather than as a group. Slightly different test procedures are used for special applications in batteryless plants.

Serial rectifiers have their own internal restart circuits that will function 3 times before the rectifier locks itself out and initiates a High Output Rectifier Fail Alarm to the controller. If there is a sufficient interval between restart and a subsequent shutdown the rectifier resets its restart counter.

The controller initiates a restart signal a few seconds after the first RFA (HO) alarm is received. After the second RFA (HO) is received, the controller waits 5 minutes before sending one additional restart signal.

Do not raise the plant bus voltage if an active load is being served. To test HVSD under this situation, ensure that sufficient battery reserve is connected to the plant bus to support the plant load. The battery may start sharing some load and BD alarms may turn on during this test.

High Float Voltage Alarm/High Voltage Shutdown Alarm Tests, continued)

HVSD Test Procedure for Serial Rectifiers, continued

Step	Action
1	Turn Off all rectifiers except the rectifier under test by operating their power switches to STANDBY. Ensure that the system is loaded to at least 10-90% of the rectifiers' output capacity.
2	From the front panel follow the path <MENU> → CONFIG → THRESH and note the value of the HV (FLOAT) threshold.
3	Press the <ESC> key to return to the Configuration screen.
4	Follow the path RECT MNGR → [RECT OPER] → PLANT V (FLOAT) from the Configuration screen. Note: Menu item in [] used in intelligent controllers only.
5	Use the <ADJUST> keys to change the value of the plant voltage to a level above the HV (FLOAT) setting noted above.
6	Press <ENTER> to save the change.
	Continued on next page.

High Float Voltage Alarm/High Voltage Shutdown Alarm Tests, continued)

HVSD Test Procedure for Serial Rectifiers, continued

Step	Action
7	Observe the following: • When the voltage increases to the HV (FLOAT) level the rectifier shuts down. • The Green ON LED on the rectifier blinks, the ALM LED on the rectifier is not lit. • After 5-6 seconds the rectifier initiates its own restart signal again, raising the plant voltage. • The rectifier will shutdown and restart three additional times. • Upon the fourth shutdown, the rectifier's ALM LED lights and the rectifier's display indicates “HO.” • The controller receives the RFA signal from the rectifier and initiates a restart signal 5-6 seconds later. • The rectifier restarts again, raising plant voltage. • The rectifier shuts down and restarts four additional times. • During these shutdowns the Green ON LED on the rectifier blinks, the ALM LED on the rectifier is not lit. • Upon the fourth shutdown, the rectifier's ALM LED lights and the rectifier’s display indicates “HO.” • An external RFA office alarm is generated.

Continued on next page.

High Float Voltage Alarm/High Voltage Shutdown Alarm Tests, continued)

HVSD Test Procedure for Serial Rectifiers, continued

Step	Action
8	The controller will wait 5-6 minutes and issue one final restart signal, initiating the final sequence of shutdown and restart events before the rectifier locks out, requiring personnel intervention. Prior to this occurring do the following: a. From the front panel follow the path <MENU> → CONFIG → RECT MNGR → [RECT OPER] → PLANT V (FLOAT). Note: Menu item in [] used in intelligent controllers only. b. Use the <ADJUST> keys to change the value of the plant voltage to its normal level. Press <ENTER> to save the change. c. Press <MENU> and select MAINT OPER → RECT RESTART. Press <ENTER> to restart the rectifier. Note: Restarting the rectifier from the front panel in this manner, rather than toggling the rectifier's ON/ STANDBY switch, resets the HVSD timer so that another rectifier can be tested immediately. Testing of the additional rectifiers in the same manner is at the user's discretion

.

Battery on Discharge Alarm Test

Introduction

If the BD alarm was observed during the High Voltage Shutdown test this test can be disregarded.

If the BD alarm was not observed during the HVSD test, perform the following test procedure:

Procedure

Step	Action
1	From the front panel follow the path <MENU> → CONFIG → THRLD and observe the setting of the BD (FLOAT) threshold.
2	Switch some of the rectifiers to STANDBY or OFF, until the remaining rectifiers go into a current limit and plant voltage drops below BD (FLOAT) threshold. Observe the active BD and MAJ LEDs and asserted PMJ and BD relays.
3	Restart the rectifiers to retire alarms and return the plant voltage to float.

Another way to perform the test is to increase the BD threshold above the normal plant float voltage, using the following steps:

Step	Action
1	From the front panel follow the path <MENU> → CONFIG → THRLD and observe the setting of the BD (FLOAT) threshold.
2	Increase the BD threshold value above the float voltage. Observe the active BD and MAJ LEDs and asserted PMJ and BD relays.
3	Reset the BD alarm to the original setting.

Rectifier Fail Alarm Test

Introduction

If the RFA alarm was observed during the High Voltage Shutdown Test no separate test is required.

If the High Voltage Shutdown Test is not performed, generate an RFA (Rectifier Fail Alarm) in each of the plant rectifiers individually, using the procedures below:

Lucent Serial Rectifiers 595 and 596 Series

For Lucent 595 and 596 Series rectifiers, follow the steps in the table below:

Step	Action
1	Turn the rectifier Off. Wait for the rectifier to power down.
2	Insert a plastic stick between the front panel grills to block the fan rotation.
3	Turn the rectifier On. After several seconds, the rectifier will issue an RFA alarm and the plant will generate a PMN.
4	Remove the fan obstruction and toggle the power switch Off and back On to restart the rectifier and retire the alarm.
5	Generate an RFA (Rectifier Fail Alarm) in each of the plant rectifiers individually and verify that the RECT and MINOR LEDs become active along with the Power Minor and RFA alarm relays.

J855- or J874-Series Rectifiers

For Lineage Power J855-series or J874-series rectifiers an RFA is easily accomplished by operating the “+V” or “-V” fuse alarm circuit by inserting a paper clip into the alarm indicating hole of the fuse holder.

Rectifier Fail Alarm Test, continued

150A SMR Rectifiers

For Lineage Power J85702E-series (150A SMR) rectifiers an RFA may be generated by using the following procedure:

Step	Action
1	Set the rectifier to the Single Power Module Assembly (PMA) Fail option by placing BGB SW100-8 to OPEN.
2	Set the Output CB switch of all three PMAs inside the rectifier to the Off position,
3	Raise the rectifier voltage (measured via the rectifier voltage test jacks on the front panel of the rectifier) above the Backup HVSD level for the rectifier (set via SW 100-6/7 on the BGB display/control card of the rectifier).
4	Verify the RFA in the controller.
5	Lower the rectifier voltage once again to plant float and restart it to retire the RFA.
6	Close the PMA Output CB switch of all three PMAs and verify normal rectifier operation

Note: Load share should be disabled (BGB SW100-5) anytime rectifier voltage is adjusted in these rectifiers with the PMA Output CBs closed.

Rectifier Fail Alarm Test, continued

50A SMR Rectifiers

Use the following procedure to generate an RFA in Lineage Power 50A SMR Series rectifiers:

Step	Action
1	Set the Output CB switch of the rectifier to the Off position.
2	Raise the rectifier voltage (measured via the rectifier voltage test jacks on the front panel of the rectifier) above the Backup HVSD level for the rectifier (set via SW100-6/7 on the front of the rectifier).
3	Verify RFA in the controller.
4	Lower the rectifier voltage once again to plant float and restart it to retire the RFA.
5	Close the Output CB switch and verify normal rectifier operation.

Note: Load share should be disabled (BGB SW100-5) anytime that rectifier voltage is adjusted in these rectifiers with the Output CBs closed.

If an intelligent controller is being tested, History for all tested alarms can be reviewed under the front panel path: MAIN → HISTORY.

Terminate Rectifier (TR) Test

Introduction

The TR test may be performed even if rectifier sequencing is not planned to be utilized, as it provides a convenient means of testing that the controller recognizes all plant rectifiers and is able to control each over their assigned ports.

Refer to Figures 2-1 and 2-2 for the BJT board of the rear access SC controller and to Figures 2-3 and 2-4 for the BLG board of the front access SCF controller.

Test Procedure

One at a time, connect a test lead on the TB3 terminal block of the BJT (SC) or BLG (SCF) termination board, from position 13 (ETRR/ Ground) to position 8 (TR1), 9 (TR2), 10 (TR3), and 11 (TR4). The rectifiers will shut down in groups as depicted below and remain Off until the connection is removed at which time they automatically restart.

TR1: G01, G02, G09, G10, G17, G18

TR2: G03, G04, G11, G12, G19, G20

TR3: G05, G06, G13, G14, G21, G22

TR4: G07, G08, G15, G16, G23, G24

Caution: When this test is performed on a live plant, it may cause a battery discharge (BD) to occur. Ensure that the battery reserve is able to support the plant load.

Fuse Alarm Test

Major Fuse Alarm

Major Fuse Alarm may be tested by placing a blown fuse in the alarm fuse position of any distribution fuse position in the plant or by inserting a paper clip into the alarm indicating hole of its fuse holder. For distribution circuit breakers, temporarily connect the pins 8 and 9 of any KS22010 or KS22012 style circuit breakers of any breaker together.

For GPS cabinets, fuse alarms may be simulated at the BNL1 or BNL7 alarm card by strapping FAJ on these cards to the hot bus (P4-1 for BNL1, P5-6 for BNL7).

The DIST and MAJ LEDs and Power Major and MJF alarm relays will be active. Alarms should be tested in each distribution bay of the plant to verify the integrity of the alarm bus throughout the plant. If the distribution bays are equipped with "Bay Fuse Alarm" indicating LEDs, also verify that this LED activates during these tests for the bay in which the alarm originates (and not in any other).

For GPS cabinets, the alarm lamp of the cabinet containing the controller will always activate, in addition to the cabinet containing the alarm.

Minor Fuse Alarm

Refer to Figures 2-1 and 2-3, respectively, for location of the BJF fuse termination board in the SC and SCF controllers.

Minor Fuse Alarm may be tested by placing a blown fuse in the alarm fuse position of the plant Capacitor Charge circuit (if equipped) or by inserting a paper clip into the alarm indicating hole of its fuse holder. Alternately, replace one of the unused regulation fuses of the BJF fuse termination board with a blown GMT type fuse. In either case, the MIN and either DIST or RECT panel LEDs will activate, along with the Power Minor and MNF alarm relays.

Modem/Data Switch

If the Modem (L-AE) and/or Data Switch (L-AH) options have been provided, they can be tested after wiring and configuration is completed by dialing into the modem port and, if equipped, passing through to the devices wired to the equipped Data Switch ports. Refer to the controller product manual for the T1.317 Data Switch commands required.

Note: If the controller is regularly accessed using a modem, from a remote monitoring station, this test may not be necessary.

Remote Peripheral Monitoring

If the Remote Peripheral Monitoring option (L-AG) and J85501G1 monitoring units have been equipped, each channel configured may be tested for accuracy with a clamp-on ammeter (for Shunt Monitor channels), voltmeter (for Voltage Monitor channels), or thermometer (for Temperature channels). If alarms have been configured through the use of User Defined Event (UDE), they may also be tested by adjusting their program line to move the thresholds or by adjusting the channel programming to change the value reported for the channel. Refer to the Remote Peripheral Monitoring System product manual for complete feature descriptions of each of these optional monitoring devices.

Once set, it is not recommended to change these UDE program lines, unless it is attempted by a qualified and skilled professional. Refer to the product manual if it is required to make any adjustments/changes to the RPM modules or UDE.

Rectifier Sequencing

If Rectifier Sequencing in an intelligent controller has been enabled (via EasyView path: MAIN → CONFIGURE → RECTIFIERS), testing can be completed by temporarily using a shorting clip across TB3 positions 12-13 (ETR/ETRR) on BJT board of the rear access SC controller (Figure 2-2) and the BLG board of the front access SC controller (Figure 2-4). This will cause all rectifiers configured for Rectifier Sequencing control to shut Off. Releasing this clip will then cause the rectifiers to restart sequentially in the manner in which they have been programmed.

Energy Management

Overview

The Energy Management algorithm exercises all rectifiers on a monthly basis, guaranteeing that every connected rectifier is operated for at least 24 hours each month. All connected rectifiers that have not operated a total of 24 hours in the previous monthly cycle will be turned on by the controller on the first Wednesday of the next month at 10:00 a.m. for 24 hours.

Energy Management is available only in the intelligent controller and must be enabled in both hardware and software. Enable the hardware switch by setting SW204-1 on the BJH board to 1. From the front panel follow the path: <MENU> → CONFIG → RECT CTR → EFFIC to enable the software switch. Energy Management can be enabled in EasyView by following the path: CONFIGURE → PLANT → HARDWARE AND SOFTWARE.

Energy Management is enabled only if all connected rectifiers provide a load signal to the controller via the VI (Voltage proportional to Load) circuit within each Lucent J855-series or J874-series rectifier control circuitry. Controllers using the BJC2 rectifier interface packs, used with rectifiers that do not issue VI signals, instead monitor the mV signal directly off the rectifier load shunt. In either case, the Energy Management algorithm requires that the individual rectifier loads be reported to the controller accurately. Verify that the load reported via front panel or EasyView path against each rectifier agrees with the actual load calculated from its shunt mV reading or read from its front panel. If necessary, adjust the VI circuit of each rectifier as outlined in the appropriate rectifier product manual. Accuracy of 2% should be achieved.

Note: It may not be necessary to perform the following Energy Management test procedure if the rectifiers used are Lineage Power serial rectifiers. Also, if a TR (terminate rectifier) status is observed on the LED display, it indicates that the Energy Management feature is functioning.

Energy Management, continued

Procedure

Step	Action
1	Reset the BJH intelligent controller (see Figure 2-3) and stabilize the load at some level at which at least one rectifier becomes unnecessary. After 10 minutes the first unneeded rectifier will be turned Off by the controller. If additional rectifiers can be shut down, they will follow individually at 10 minute intervals.
2	If the plant load can be varied, increase it to the point where another rectifier is necessary after the controller has completed its shutdowns. One (or more as required) of the rectifiers will be restarted immediately when the load exceeds the capacity of the current on-line rectifiers
3	Observe that the BD alarm is inhibited during the rectifier walk-in period.

Meter Calibration from the Front Panel

Voltage Calibration

Step	Action
1	Using a calibrated DVM, measure the plant voltage from the front panel voltage test jacks.
2	From the front panel press <MENU> → CONFIG → PLANT. Using the Arrow keys, reset the plant voltage reading by selecting RST PLV. Press <ENTER> to reset. This will remove any pre-existing user calibrated values if they exist.
3	Press the <MENU> key, wait five seconds, and go back to the CONFIG → DC PLT screen. Move to ADJ PLV on the menu and use the <ADJUST> keys to calibrate the plant voltage to match the reading of the DVM. Press <ENTER> to use the new calibrated plant voltage.
4	Press the <ESCAPE> key until the default screen is displayed. Verify that the plant voltage reading reflects the same reading as shown on the DVM. Note that in a serial plant, the actual plant voltage reflected by the DVM will change, not the reading reflected on the display.

Meter Calibration from the Front Panel, continued

Current Calibration

The following procedure is applicable only in plants with Load shunts in a plant configured for "Centralized Architecture."

Step	Action
1	Using a calibrated DVM, measure the plant load from the front panel current test jacks in mV.
2	To calculate the plant load, in amperes, as measured by the DVM, divide the mV DVM reading by the rated shunt mV value. Multiply this result by the shunt ampere rating. This value is the plant load measured by the DVM, in amperes.
3	From the front panel press <MENU> → CONFIG → PLANT. Using the Arrow keys, reset the plant current reading by selecting RST PLI. Press the <ENTER> key to reset. This will remove any pre-existing user calibrated values if they exist.
4	Press the <MENU> key, wait five seconds, and go back to the CONFIG → PLANT screen. Move to ADJ PLI on the menu and use the <ADJUST> keys to calibrate the plant load to match the calculated plant load value. Press <ENTER> to use the new calibrated plant load.
5	Press the <ESCAPE> key until the default screen is displayed. Verify that the plant load reading reflects the new value.

Battery Discharge Test

Overview

The Battery Discharge Test feature dynamically tests the health of the system's batteries by controlling rectifier voltage to allow the batteries to discharge into the plant load. A Bell Labs patented algorithm collects battery information during the discharge and predicts the battery reserve time. To initiate the test, the plant must be operating in the Float mode with no active alarms and only serial type rectifiers connected. The test is completed when approximately 20 percent of anticipated battery capacity is removed. During the test, slope thermal compensation and boost modes will be temporarily disabled. The controller Reserve Time field will display "Test in Progress" and the BAT LED and the BD external alarm relay will be activated. BD and Very Low Voltage alarm thresholds will be temporarily inhibited.

It is a good practice to do a discharge test on the batteries, at least once a year, or more frequently, if required.

Note: The Battery Discharge Test is for informational and planning purposes only. It does not constitute the basis for warranty resolutions.

The battery test is aborted if any of the following conditions occur:

- 100 minutes elapses and 20 percent capacity has not been removed
- Battery voltage declines to the highest of the following computed values:
  - (1.75 x No. of cells) + 1.2 [48V] or + .6 [24V]
  - Highest LVD disconnect threshold + 1.2 [48V] or + .6 [24V]
  - Converter disconnect threshold + 1.2 [48V] or + .6 [24V]
  - (Configured end cell voltage x No. of cells) + 1.2 [48V] or + .6 [24V]
- A voltage sense fuse operates
- A rectifier fail alarm occurs
- Any serial communication failure occurs
- Any power major alarm occurs

Battery Discharge Test, continued

Overview, continued

The intelligent controller provides an enhanced battery discharge test that makes even greater accuracy possible. Enabling the "ENHANCED" software switch utilizes the Universal Reserve Time Prediction algorithm, which takes into account the particular discharge characteristics of the battery subsystem. The URPT feature requires that battery temperature be monitored and several related battery parameters be configured. Ensure that the correct battery model is chosen for the plant.

Note: The Battery Discharge Test feature is available with controller software Version 6.5 for the SC controller.

Discharge Menu

This menu allows you to configure the various parameters for the Battery Discharge Test and Reserve Time Predictor features of the controller:

MENU → BATTERY MANAGEMENT → BAT DISCH

BATTERY DISCHARGE TEST

BAT TEST	: EN	ENHANCED	: EN
BAT TYPE	: EN	CELL STRING	: 12
NUM STRING	: 24	END V/CELL	: 1.75
BAT CLASS	: FLOODED		

BAT TEST: Enable Battery Discharge Test by using the <+> and <-> keys to toggle between enable or disable. Press <ENTER> to save.

ENHANCED: Use the <+> and <-> keys to enable enhanced feature, if intelligent controller is present.

BAT TYPE: Use the <+> and <-> keys to select the battery installed on site. (The Menu contains a list of 10 batteries.) Press <ENTER> to save. Note: This feature is only available with the intelligent option.

CELL STRING: Use the <+> and <-> keys to select the number of cells per string. (Select 12 for a 24V plant, or 24 for a 48V plant.) Press <ENTER> to save.

Battery Discharge Test, continued

Discharge Menu, continued

NUM STRING: Use the <+> and <-> keys to select the number of strings installed on the site. (Range is 1 to 32 strings, default is 2.) Press <ENTER> to save.

END V/CELL: Use the <+> and <-> keys to select the cell voltage at the end of the discharge test. (Default value is 1.75V, and is adjustable between 1.75V and 1.95V.) Press <ENTER> to save.

BAT CLASS: Use the <+> and <-> keys to select flooded or sealed. Press <ENTER> to save. Note: Use this feature only is the basic controller is present.

Configuration

Configuration may be done locally at the front panel or remotely via EasyView interface.

Basic: MENU → CONFIG.. → BAT TEST

Intelligent: MENU → CONFIG.. → BAT MNGR → BAT DISCH..

EasyView: CONFIG → BATTERY MANAGEMENT → RESERVE

To initiate the test, the plant must be operating in the Float mode with no active alarms and only serial type rectifiers connected. The test can be controlled either locally at the front panel or remotely via EasyView interface by toggling the BAT DISCH TST software switch.

Basic: MENU → MAINT OPER.. → BAT DISCH TST

Intelligent: MENU → MAINT OPER.. → BAT DISCH TST

EasyView: CONTROL → BATTERY TEST

Battery Discharge Test, continued

Procedure

Step	Action
1	Enable BATT TEST: MENU → BATTERY MANAGEMENT → BAT DISCH Note: Once the other parameters on this screen are configured, do not modify until any system changes are made.
2	Press <ENTER> to confirm test to proceed. Controller will perform the battery discharge test.
3	Verify: • BD alarm will turn On and Status LED will show Green (NORM). • Controller display will show BATT TEST at bottom left and RESERVE TEST IN PROGRESS on bottom right.
4	To abort Battery Discharge Test: a. Follow menu path MENU → MAINT OPER → BAT DISCH TST b. Verify that display shows “Battery Discharge Test Aborted.”

Note: The Battery Discharge Test is for informational and planning purposes only. It does not constitute the basis for warranty resolutions.

If the test is aborted due to an alarm, the Reserve Time message is displayed as “Alarm Abort” and a user clearable minor alarm is generated. If the test is aborted due to any of the other conditions shown above, the Reserve Time message is displayed as “Check Battery” and a user clearable minor alarm is generated.

Battery Discharge Test, continued

Test Completion

The test is completed when approximately 20 percent of anticipated battery capacity is depleted.

At the completion of the test, BD and VLV alarm thresholds continue to be inhibited for 3 additional minutes to allow the batteries to recharge. A successful test displays the calculated value in the Reserve Time field; default menu in the intelligent controller or menu path MENU → MAINT OPER.. in the basic controller. Reserve time in EasyView is displayed at menu path: STATUS → DC PLANT.

3 Galaxy Millennium Controller Performance Verification Procedures

Introduction

The procedures in this section may be used to test the different alarms in a live Galaxy Millennium Controller system.

Follow the steps of the procedures in the order they are given.

Tools

The following tools are required to complete the tests described in this section:

- Digital Voltmeter (DVM) with dc accuracy of at least 0.05%
- Short length of wire or clip lead for jumper
- Jeweler's screwdriver

Precautions

Before performing the test procedures, verify that the following conditions exist:

- All rectifiers are functioning properly.
- Plant batteries are fully charged and are ready to support a load. (See Caution below.)

  Caution: When Alarm Tests are performed on a live plant, some of the tests will cause a battery discharge to occur. In this case, ensure that the plant batteries are capable of supporting the load. It is recommended that a battery discharge test be performed before proceeding with other tests.

Follow the steps of the procedures in the order they are given.

Lamp Test

Depress the <LAMP TEST> key on the controller's front display interface. All LEDs on the controller front panel, controller boards, and Lucent serial rectifiers will turn on momentarily and then retire.

Alarm Test

Overview

Alarm Test provides a method of testing the operation of all or any of the plant alarm relays and their wiring to the connected alarm system. This test cannot be done if any alarms are active. It may also be desirable to perform this test occasionally after the plant is in service to verify the integrity of the office alarms for the power plant. Alarm Test may be performed locally or from a remote terminal.

The Alarm Test feature will, in succession, operate each of the controller alarm relays. With the basic controller, the default duration is one minute. With the intelligent option for the controller, the selection of the relays to be operated and default duration can be changed using the EasyView interface.

Switch Positions

Figure 3-1 shows the switch positions referred to in these procedures.

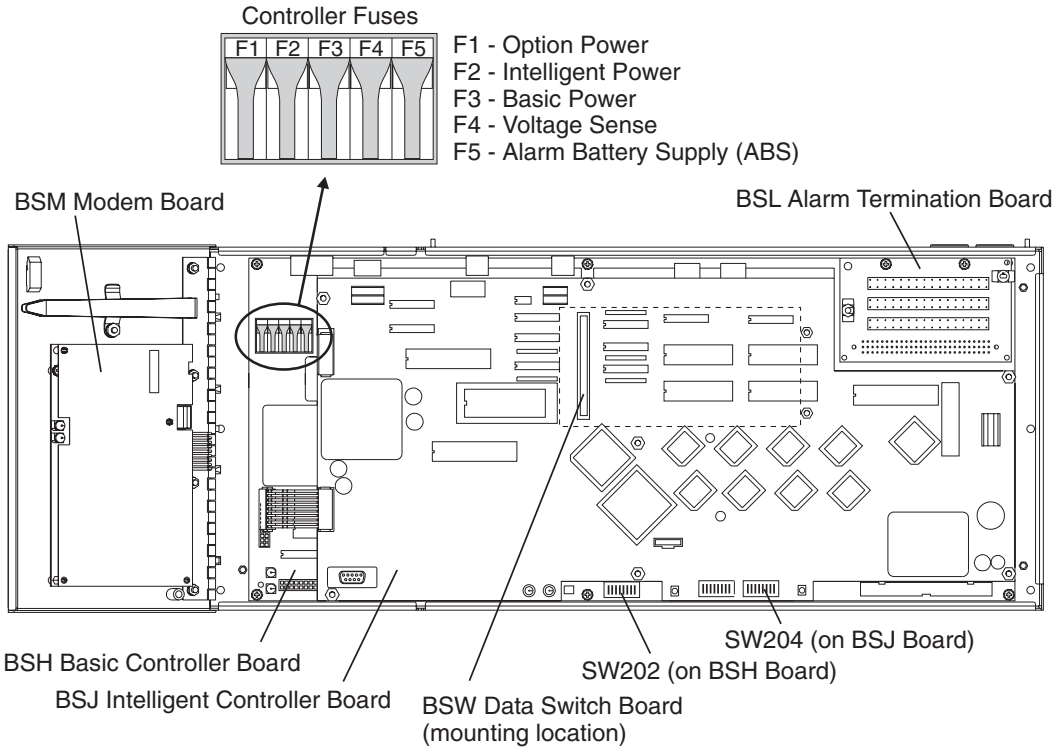


Figure 3-1: Galaxy Millennium Controller Switch Positions

Alarm Test, continued

Local Alarm Test

Refer to Figure 3-1 for the Millennium switch positions referred to in this test.

Prior to performing an Alarm Test, hardware switch SW202-5 on the BSH board must be enabled, in addition to the software switch located at menu path:

Basic: <MENU> → CONFIG → ALARM → TEST ALM
Intelligent: <MENU> → CONFIG → ALARM → TEST ALM

If HVSD is desired during the test, BSH SW202-4 must also be enabled, along with the appropriate software switch found on the front panel under the path: MAIN → CONFIG → ALARM → TEST HV, and each plant rectifier must have a load of at least 10% of its capacity.

To perform the Alarm Test from the front panel, follow the menu path:

Basic: <MENU> → MAINT OPER → ALARM TEST
Intelligent: <MENU> → MAINT OPER → ALARM TEST

As an alternative to the front panel configuration of the Alarm Test software switch, it may be also configured within EasyView under the path: CONFIGURE → DC PLANT → HARDWARE & SOFTWARE CONFIGURED.

Pressing the <ENTER> key while the cursor is on the ALARM TEST field will provide the message “ALARM TEST STARTED.” Use the <ESC> key to return to the MAINTENANCE OPERATION screen and follow the relay operation in the ALARM TEST STAT: field. Pressing <ENTER> while the cursor is on the ALARM TEST field will restart the test.

Note: Front panel LEDs do not activate during the Alarm Test. the alarms can be monitored by checking on the BSL alarm board.

Alarm Test, continued

Local Alarm Test, continued

The Alarm Test will operate, in sequence, each of the relays shown below for a default interval of approximately 60 seconds. This interval for each relay's activation during this test may optionally be set in an intelligent controller via EasyView path: MAIN → CONFIGURE → ALARM TEST.

Initiate Alarm Test locally by pressing the <MENU> key to bring up the MAIN screen and following the path: MAINT OPER → ALARM TEST. The ALM TEST STAT field of this same screen can then be used to follow the progress of the alarm text.

The progress of the activated relays can also be followed during the test by sensing for continuity on the appropriate positions of the BSL alarm board if the connected alarm system is not yet processing.

High Voltage Shutdown - HVSD*
Rectifier Fail Alarm Test - RFAT**
Power Critical - PCR
Power Major - PMJ
Power Minor - PMN
Major Fuse - MJF
Minor Fuse - MNF
Battery on Discharge - BD
AC Fail - ACF
Rectifier Fail Alarm - RFA
User Relay 3 - UR3***
High Voltage - HV
Controller - CTLR
User Relay 1 - UR1***
User Relay 2 - UR2***

*HVSD is optional.

**RFAT is an alarm test intended for use with non-serial type rectifiers and has no function in this test.

***UR1, UR2, and UR3 are inhibited if LVD Contactors have been configured and a Bay Interface Card is not configured in the system.

Follow the status of the test remotely with EasyView path: STATUS → ALARM TEST.

Alarm Test, continued

Remote Alarm Test

Using EasyView to perform the Alarm Test, hardware switches SW202-5 on the BSH board and SW204-2 on the BSJ board (Figure 3-1) must first be enabled, in addition to the software switches located at menu path.

EasyView: CONFIGURE → DC PLANT → HARDWARE AND SOFTWARE CONFIGURED

Both the Alarm Test and Remote Alarm Test fields must be enabled.

To start the Alarm Test in EasyView, follow the menu path:

EASYVIEW: CONTROL → ALARM TEST

A dialog box will appear with the status of the alarm relays being tested. See above for the order in which the alarm relays will operate.

The selection of relays to be operated, as well as the duration of relay operation, may be selected in EasyView by following the menu path:

EASYVIEW: CONFIGURE → ALARM TEST

High Float Voltage Alarm Test

Introduction

The High Voltage Alarm Test can be done by either raising the plant voltage above the threshold set for HFV (High Float Voltage) or by lowering the threshold for this condition to make it active.

Note: HFV is an alarm-only that can be used to notify users of an impending HV condition before the need for a shutdown arises.

Raising the plant voltage on a working system is left to the discretion of the user. This test could disrupt power to working equipment. If the test is performed, verify that the plant is in FLOAT mode and that rectifier voltage has been set to the normal level after completing the test.

Tests need to be done with batteries connected, or else when the rectifiers shut down, the controller will also shut down.

Preparations

Note the value of plant voltage from the Default screen. Use the following table to record settings before beginning the test procedures:

Plant Nominal Float Voltage	HV	HFV

Testing High Float Voltage Alarms

Step	Action
1	From the front panel, follow the path <MENU> → CONFIG → THRESH → HFV (FLOAT). Use the <Adjust> keys to change the value of the HFV threshold to a level below the plant voltage noted above. Press <ENTER> to save the change.
2	Observe that the controller initiates a Power Minor alarm (PMN) and illuminates the RECT and MIN LEDs.
3	Follow the path <MENU> → CONFIG → THRESH → HFV (FLOAT) and restore the threshold to it's original setting. Press <ENTER> to save the change.

High Voltage Shutdown Test

Overview

A High Voltage Shutdown signal (HVSD) may optionally be sent to the rectifiers during the alarm test by enabling the hardware switch SW202-4 on the BSH board and the software switch at menu path:

Basic: <MENU> → CONFIG → ALARM → TEST HV
Intelligent: <MENU> → CONFIG → ALARM → TEST HV

Use the ADJUST <+> <-> keys to change the value of the TEST HV field, then press <ENTER> to save the change.

Note: The High Voltage Shutdown Test is not recommended for an existing installation. However, if this test must be done, make sure that the battery reserve can support the load for the period until the rectifier is recycled.

Verify the Auto Restart hardware switch at SW202-7 on the BSH board is set to 1 (Enabled). Verify the software switch for the Auto Restart feature is enabled from the front panel. MAIN → CONFIG → RECT CTR → AUTO RST

High Voltage Shutdown Test, continued

Serial Rectifiers

There are three requirements for a serial rectifier to shut down upon a controller-initiated High Voltage Alarm:

- The plant voltage must be above the level set for HV at the front panel path: <MENU> → CONFIG → THRESH.
- The rectifier must be delivering a current exceeding 10% of it's capacity.
- The rectifier's current output must be unbalanced by more than 10% from the average output currents of the other rectifiers. Because this is difficult to achieve in a simulation test of properly functioning serial rectifiers, even with load share disabled, rectifiers are tested one at a time rather than as a group. Slightly different test procedures are used for special applications in batteryless plants.

Note: In an active plant with serial rectifiers the plant High Voltage (HVSD) test can be performed with only one rectifier in operation, in order to satisfy all three conditions mentioned above.

Serial rectifiers have their own internal restart circuits that will function 3 times before the rectifier locks itself out and initiates a High Output Rectifier Fail Alarm to the controller. If there is a sufficient interval between restart and a subsequent shutdown the rectifier resets its restart counter.

The controller initiates a restart signal a few seconds after the first RFA (HO) alarm is received. After the second RFA (HO) is received, the controller waits 5 minutes before sending one additional restart signal.

High Voltage Shutdown Test, continued

Battery Plant HVSD Test

Step	Action
1	Turn Off all rectifiers except the rectifier under test by operating their power switches to STANDBY. Perform these tests when loads provide 10-90% of the rectifiers output capacity.
2	From the front panel follow the path <MENU> → CONFIG → THRESH and note the value of the HV (FLOAT) threshold.
3	Press the <ESC> key to return to the Configuration screen.
4	Follow the path RECT MNGR → [RECT OPER] → PLANT V (FLOAT) from the Configuration screen. Note: Menu item in [] used in intelligent controllers only.
5	Use the <ADJUST> keys to change the value of the plant voltage to a level above the HV (FLOAT) setting noted above.
6	Press <ENTER> to save the change.
	Continued on next page.

High Voltage Shutdown Test, continued

Battery Plant HVSD Test, continued

Step	Action
7	Observe the following: • When the voltage increases to the HV (FLOAT) level the rectifier shuts down. • The Green ON LED on the rectifier blinks, the ALM LED on the rectifier is not lit. • After 5-6 seconds the rectifier initiates its own restart signal again, raising the plant voltage. • The rectifier will shutdown and restart three additional times. • Upon the fourth shutdown, the rectifier's ALM LED lights and the rectifier's display indicates "HO." • The controller receives the RFA signal from the rectifier and initiates a restart signal 5-6 seconds later. • The rectifier restarts again, raising plant voltage. • The rectifier shuts down and restarts four additional times. • During these shutdowns the Green ON LED on the rectifier blinks and the ALM LED on the rectifier is not lit. • Upon the fourth shutdown, the rectifier's ALM LED lights and the rectifier's display indicates "HO." • An external RFA office alarm is generated
	Continued on next page.

High Voltage Shutdown Test, continued

Battery Plant HVSD Test, continued

Step	Action
8	The controller will wait 5-6 minutes and issue one final restart signal, initiating the final sequence of shutdown and restart events before the rectifier locks out, requiring personnel intervention. Prior to this occurring do the following: a. From the front panel follow the path <MENU> → CONFIG → RECT MNGR → [RECT OPER] → PLANT V (FLOAT). Note: Menu item in [] used in intelligent controllers only. b. Use the <ADJUST> keys to change the value of the plant voltage to its normal level. Press <ENTER> to save the change. c. Press <MENU> and select MAINT OPER → RECT RESTART. Press <ENTER> to restart the rectifier. Note: Restarting the rectifier from the front panel in this manner, rather than toggling the rectifier's ON/STANDBY switch, resets the HVSD timer so that another rectifier can be tested immediately. Testing of the additional rectifiers in the same manner is at the user's discretion

Battery on Discharge Alarm Test

If the BD alarm was observed during the High Voltage Shutdown test this test can be disregarded.

If the BD alarm was not observed during the High Voltage Shutdown test, do the following:

Step	Action
1	From the front panel follow the path <MENU> → CONFIG → THRLD and observe the setting of the BD (FLOAT) threshold.
2	Switch some of the rectifiers to STANDBY or OFF, until the remaining rectifiers go into a current limit and plant voltage drops below BD (FLOAT) threshold. Observe the active BD and MAJ LEDs and asserted PMJ and BD relays.
3	Restart the rectifiers to retire alarms and return the plant voltage to float.

Rectifier Fail Alarm Test

If the RFA alarm was observed during the High Voltage Shutdown Test no separate test is required.

If the High Voltage Shutdown Test is not performed, generate an RFA (Rectifier Fail Alarm) in each of the plant rectifiers individually, using the following procedure:

Step	Action
1	Turn the rectifier Off. Wait for the rectifier to power down.
2	Insert a plastic stick between the front panel grills to block the fan rotation.
3	Turn the rectifier On. Wait for a few seconds; the rectifier must issue an RFA alarm and the plant must generate a PMN.
4	Remove the fan obstruction and toggle the power switch Off and back On to restart the rectifier and retire the alarm.
5	Generate an RFA (Rectifier Fail Alarm) in each of the plant rectifiers individually and verify that the RECT and MINOR LEDs become active along with the Power Minor and RFA alarm relays.

Terminate Rectifier (TR) Test

Introduction

The TR test may be performed even if rectifier sequencing is not planned to be utilized, as it provides a convenient means of testing that the controller recognizes all plant rectifiers and is able to control each over their assigned ports.

Refer to Figure 3-1 for location of the BSL board.

Procedure

One at a time, connect a test lead on the BSL alarm interface terminal block from position 76 (ETRR/Ground) to position 73 (TR1), 79 (TR2), 85 (TR3), and 80 (TR4). The rectifiers will shut down in groups as depicted below and remain Off until the connection is removed at which time they automatically restart.

TR1:	G01, G02, G09, G10, G17, G18
TR2:	G03, G04, G11, G12, G19, G20
TR3:	G05, G06, G13, G14, G21, G22
TR4:	G07, G08, G15, G16, G23, G24

Note: This function can be performed by using EasyView.

Caution: When this test is performed on a live plant, it may cause a battery discharge (BD) to occur. Ensure that the battery reserve is able to support the plant load.

Fuse Alarm Test

Introduction

If there are any site installed fuses, they can be tested for alarm functionality by generating alarms for the controller at these points. If this is not possible, they can be tested by simulating alarm conditions at the BSL board (see Figure 3-1) on the Millennium Controller by following the steps given below.

Major Fuse Alarm (FAJ)

Connect a jumper (through a 1K resistor) between Pin 63 (FAJ) and Pin 93 (ABS) on BSL Board (see Tables 3B, 3C and 3D in the Millennium controller manual for details of these pin assignments). DIST and MAJ LEDs will light up. MJF default relay will be activated.

For GPS cabinets, fuse alarms may be simulated at the BNL1 or BL7 alarm card by strapping FAJ on these cards to the hot bus (P4-1 for BNL1, P5-6 for BNL7).

Minor Fuse Alarm (FAN)

Connect a jumper (through a 1K resistor) between Pin 65 (FAN) and Pin 93 (ABS) on BSL Board (see Tables 3B, 3C, and 3D in the Millennium controller manual for details of these pin assignments). DIST and MIN LEDs will light up. MNF default relay will be activated.

Modem/Data Switch

If the Modem (L-AE) and/or Data Switch (L-AH) options have been provided, they can be tested after wiring and configuration is completed by dialing into the modem port and, if equipped, passing through to the devices wired to the equipped Data Switch ports. Refer to the controller product manual for T1.317 Data Switch commands.

Note: If the controller is regularly accessed using a modem, from a remote monitoring station, this test may not be necessary.

Remote Peripheral Monitoring

If J85501G-1 Remote Peripheral Monitoring units have been equipped, each channel configured may be tested for accuracy with a clamp-on ammeter (for Shunt Monitor channels), voltmeter (for Voltage Monitor channels), or thermometer (for Temperature channels). If alarms have been configured through the use of User Defined channels, they may also be tested by adjusting their program line to move the thresholds or by adjusting the channel programming to change the value reported for the channel.

Once set, it is not recommended to change these UDE program lines, unless it is attempted by a qualified and skilled professional. Refer to the product manual if it is required to make any adjustments/changes to the RPM modules or UDE.

Rectifier Sequencing

If Rectifier Sequencing in an intelligent controller has been enabled (via EasyView path: MAIN → CONFIGURE → RECTIFIERS), testing can be completed by temporarily using a shorting clip across BSL2 Alarm Interface positions 75-76 (ETR/ETRR) This will cause all rectifiers configured for Rectifier Sequencing control to shut Off. Releasing this clip will then cause the rectifiers to restart sequentially in the manner in which they have been programmed.

Energy Management

Overview

The Energy Management algorithm matches the number and ampacities of all available battery plant rectifiers to the actual plant load requirements, favoring the shutdown of rectifiers when plant load requirements are low enough to warrant selected rectifier shutdown, thus maintaining the battery plant at maximum efficiency without sacrificing reliability or creating nuisance alarms. The Galaxy controller continuously monitors the number of connected rectifiers, their individual ampacities, the actual output current being delivered by each and the actual office load-current demand.

The Energy Management algorithm exercises all rectifiers on a monthly basis, guaranteeing that every connected rectifier is operated for at least 24 hours each month. All connected rectifiers that have not operated a total of 24 hours in the previous monthly cycle will be turned On by the controller on the first Wednesday of the next month at 10:00 a.m. for 24 hours.

Energy Management is available only in the intelligent controller and must be enabled in both hardware and software. Enable the hardware switch by setting SW204-1 on the BSJ board to 1. From the front panel follow the path: <MENU> → CONFIG → RECT CTR → EFFIC to enable the software switch. Energy Management can be enabled in EasyView by following the path: CONFIGURE → PLANT → HARDWARE AND SOFTWARE.

Procedure

Step	Action
1	Reset the BSJ intelligent controller (Figure 3-1) and stabilize the load at some level at which at least one rectifier becomes unnecessary. After 10 minutes, the first unneeded rectifier will be placed in standby by the controller. If additional rectifiers can be shut down, they will follow individually at 10 minute intervals.
2	If the plant load can be varied, increase it to the point where another rectifier is necessary after the controller has completed its shutdowns. One (or more as required) of the rectifiers will be restarted immediately when the load exceeds the capacity of the current on-line rectifiers.

Note: If energy management is always enabled, it may not be required to do this test, especially if some of the rectifiers are in “TR” mode.

Meter Calibration from the Front Panel

Voltage Calibration

Step	Action
1	Using a calibrated DVM, measure the plant voltage from the front panel voltage test jacks.
2	From the front panel press <MENU> → CONFIG → PLANT. Using the Arrow keys, reset the plant voltage reading by selecting RST PLV. Press <ENTER> to reset. This will remove any pre-existing user calibrated values if they exist.
3	Press the <MENU> key, wait five seconds, and go back to the CONFIG → DC PLT screen. Move to ADJ PLV on the menu and use the <ADJUST> keys to calibrate the plant voltage to match the reading of the DVM. Press <ENTER> to use the new calibrated plant voltage.
4	Press the <ESCAPE> key until the default screen is displayed. Verify that the plant voltage reading reflects the same reading as shown on the DVM. Note that in a serial plant the actual plant voltage reflected by the DVM will change, not the reading reflected on the display.

Meter Calibration from the Front Panel, continued

Current Calibration

The following procedure is applicable only in plants with Load shunts in a plant configured for "Centralized Architecture."

Step	Action
1	Using a calibrated DVM, measure the plant load from the sense connection points on the plant shunt(s).
2	To calculate the plant load, in amperes, as measured by the DVM, divide the mV DVM reading by the rated shunt mV value. Multiply this result by the shunt ampere rating. This value is the plant load measured by the DVM, in amperes.
3	From the front panel press <MENU> → CONFIG → PLANT. Using the Arrow keys, reset the plant current reading by selecting RST PLI. Press the <ENTER> key to reset. This will remove any pre-existing user calibrated values if they exist.
4	Press the <MENU> key, wait five seconds, and go back to the CONFIG → PLANT screen. Move to ADJ PLI on the menu and use the <ADJUST> keys to calibrate the plant load to match the calculated plant load value. Press <ENTER> to use the new calibrated plant load.
5	Press the <ESCAPE> key until the default screen is displayed. Verify that the plant load reading reflects the new value.

Battery Discharge Test

Overview

The Battery Discharge Test feature dynamically tests the health of the system's batteries by controlling rectifier voltage to allow the batteries to discharge into the plant load. A Bell Labs patented algorithm collects battery information during the discharge and predicts the battery reserve time. To initiate the test, the plant must be operating in the Float mode with no active alarms and only serial type rectifiers connected. The test is completed when approximately 20 percent of anticipated battery capacity is removed. During the test, slope thermal compensation and boost modes will be temporarily disabled. The controller Reserve Time field will display "Test in Progress" and the BAT LED and the BD external alarm relay will be activated. BD and Very Low Voltage alarm thresholds will be temporarily inhibited.

It is a good practice to do a discharge test on the batteries, at least once a year, or more frequently, if required.

Note: The Battery Discharge Test is for informational and planning purposes only. It does not constitute the basis for warranty resolutions.

The battery test is aborted if any of the following conditions occur:

- 100 minutes elapses and 20 percent capacity has not been removed
- Battery voltage declines to the highest of the following computed values:
  - (1.75 x No. of cells) + 1.2 [48V] or + .6 [24V]
  - Highest LVD disconnect threshold + 1.2 [48V] or + .6 [24V]
  - Converter disconnect threshold + 1.2 [48V] or + .6 [24V]
  - (Configured end cell voltage x No. of cells) + 1.2 [48V] or + .6 [24V]
- A voltage sense fuse operates
- A rectifier fail alarm occurs
- Any serial communication failure occurs
- Any power major alarm occurs

Battery Discharge Test, continued

Overview, continued

The intelligent controller provides an enhanced battery discharge test that makes even greater accuracy possible. Enabling the "ENHANCED" software switch utilizes the Universal Reserve Time Prediction algorithm, which takes into account the particular discharge characteristics of the battery subsystem. The URPT feature requires that battery temperature be monitored and several related battery parameters be configured. Ensure that the correct battery model is chosen for the plant.

Note: The Battery Discharge Test feature is available with controller software Version 6.1 for the Millennium controller.

Discharge Menu

This menu allows you to configure the various parameters for the Battery Discharge Test and Reserve Time Predictor features of the controller:

MENU → BATTERY MANAGEMENT → BAT DISCH

```
BATTERY DISCHARGE TEST

BAT TEST     : EN          ENHANCED    : EN
BAT TYPE     : EN          CELL STRING : 12
NUM STRING: 24             END V/CELL  : 1.75
BAT CLASS    : FLOODED
```

BAT TEST: Enable Battery Discharge Test by using the <+> and <-> keys to toggle between enable or disable. Press <ENTER> to save.

ENHANCED: Use the <+> and <-> keys to enable enhanced feature, if intelligent controller is present.

BAT TYPE: Use the <+> and <-> keys to select the battery installed on site. (The Menu contains a list of 10 batteries.) Press <ENTER> to save. Note: This feature is only available with the intelligent option.

CELL STRING: Use the <+> and <-> keys to select the number of cells per string. (Select 12 for a 24V plant, or 24 for a 48V plant.) Press <ENTER> to save.

Battery Discharge Test, continued

Discharge Menu, continued

NUM STRING: Use the <+> and <-> keys to select the number of strings installed on the site. (Range is 1 to 32 strings, default is 2.) Press <ENTER> to save.

END V/CELL: Use the <+> and <-> keys to select the cell voltage at the end of the discharge test. (Default value is 1.75V, and is adjustable between 1.75V and 1.95V.) Press <ENTER> to save.

BAT CLASS: Use the <+> and <-> keys to select flooded or sealed. Press <ENTER> to save. Note: Use this feature only is the basic controller is present.

Configuration

Configuration may be done locally at the front panel or remotely via EasyView interface.

Basic: MENU → CONFIG.. → BAT TEST

Intelligent: MENU → CONFIG.. → BAT MNGR → BAT DISCH..

EasyView: CONFIG → BATTERY MANAGEMENT → RESERVE

To initiate the test, the plant must be operating in the Float mode with no active alarms and only serial type rectifiers connected. The test can be controlled either locally at the front panel or remotely via EasyView interface by toggling the BAT DISCH TST software switch.

Basic: MENU → MAINT OPER.. → BAT DISCH TST

Intelligent: MENU → MAINT OPER.. → BAT DISCH TST

EasyView: CONTROL → BATTERY TEST

Battery Discharge Test, continued

Procedure

Step	Action
1	Enable BATT TEST: MENU → BATTERY MANAGEMENT → BAT DISCH Note: Once the other parameters on this screen are configured, do not modify until any system changes are made.
2	Press <ENTER> to confirm test to proceed. Controller will perform the battery discharge test.
3	Verify: • BD alarm will turn On and the Status LED will show Green (NORM). • Controller display will show BATT TEST at bottom left and RESERVE TEST IN PROGRESS on bottom right.
4	To abort Battery Discharge Test: a. Follow menu path MENU → MAINT OPER → BAT DISCH TST b. Verify that display shows “Battery Discharge Test Aborted.”

Note: The Battery Discharge Test is for informational and planning purposes only. It does not constitute the basis for warranty resolutions.

If the test is aborted due to an alarm, the Reserve Time message is displayed as “Alarm Abort” and a user clearable minor alarm is generated. If the test is aborted due to any of the other conditions shown above, the Reserve Time message is displayed as “Check Battery” and a user clearable minor alarm is generated.

Battery Discharge Test, continued

Test Completion

The test is completed when approximately 20 percent of anticipated battery capacity is depleted.

At the completion of the test, BD and VLV alarm thresholds continue to be inhibited for 3 additional minutes to allow the batteries to recharge. A successful test displays the calculated value in the Reserve Time field; default menu in the intelligent controller or menu path MENU → MAINT OPER.. in the basic controller. Reserve time in EasyView is displayed at menu path: STATUS → DC PLANT.

4 Replacement Procedures

Overview

This section provides the following replacement procedures:

- Controller
  - Memory Battery Replacement for SC and SCF controllers
  - Memory Battery Replacement for Millennium controller
- GPS2424
  - Installing or Replacing a 596B3 Rectifier
  - Replacing a 596B3 Rectifier Fan Assembly
  - Replacing a 597A or 597B Converter Carrier
  - Replacing a 47A Converter Module
  - Replacing a 128A Converter Interface Card
  - Replacing a Converter Fan Assembly
- GPS4812
  - Installing or Replacing a 596A Rectifier
  - Replacing a 596A Rectifier Fan Assembly
- GPS4848
  - Installing or Replacing a 595A or 595B Rectifier
  - Removing a Rectifier
  - Replacing a 595A or 595B Rectifier Fan Assembly

Memory Backup Battery Replacement for SC/SCF Controller

Introduction

The memory backup battery is located on the BJH (Intelligent Controller) circuit pack. The battery provides power to retain system configuration stored in memory in the event the BJH circuit pack is removed or input power to the Galaxy Controller is interrupted. Battery life is usually about five years.

When the memory backup battery is low, the Memory Backup Battery Low warning is active and the battery should be replaced. Perform the following three procedures to replace the memory backup battery to prevent loss of system configuration:

- Backup System Configuration
- Replace Memory Backup Battery
- Restore System Configuration

Backup System Configuration

Use the EasyView software to perform a backup of the system configuration. Refer to the discussion of EasyView in the controller product manual. (If you need to install EasyView for the first time, see the Product Manual "EasyView Software for the Galaxy Controller," Select Code 193-104-105.) Follow these steps to perform the backup:

Step	Action
1	Log in and begin an EasyView session.
2	Open the File menu and select Backup. Select a filename and directory to store the system configuration. Click OK. EasyView displays the status of the backup. Click OK when the Backup operation is completed.
3	Open the Options menu and select Setup Sites. Select your connection profile from the Site list. Click Modify. Change the Administrator password to the default password "administrator." Change the Connect password to "administrator." Click OK. Click Close.
4	Open the Connect menu and select Disconnect to end the EasyView session.

Memory Backup Battery Replacement for SC/SCF Controller, continued

Replace Memory Backup Battery

You must remove the BJH Intelligent Controller circuit pack to replace the battery. Follow these steps:

Step	Action
1	Identify the BJJ Intelligent Power board (far left position) and pull its circuit pack locking lever forward and downward to release it from the backplane. Slide the pack straight out until fully disengaged from the backplane.
2	Identify the BJH Intelligent Controller circuit pack and pull its locking lever forward and downward to unlock the pack. Then slide the pack straight out of the card cage.
3	Remove the memory battery. Take care not to flex the battery holder clip excessively.
4	Insert the memory battery (Panasonic BR2032 or equivalent, Lucent Comcode 406526079) into the BJH (Intelligent Controller) circuit pack X201 battery holder. Observe proper polarity; the battery holder clip contacts the “+” side of the memory battery. Take care not to flex the battery holder clip excessively.
5	Align the BJH Intelligent Controller circuit pack with the circuit pack tracks and carefully slide the circuit pack into the card cage. Seat and lock the circuit pack into the card cage by lifting the circuit pack locking lever to the full upright position.
6	Reengage the BJJ Intelligent power board into the backplane and lift its circuit pack locking lever into the full upright position. Observe active green LEDs on all packs after approximately one minute.

Memory Backup Battery Replacement for SC/SCF Controller, continued

Restore System Configuration

Step	Action
1	Log in and begin an EasyView session using the previously modified connection profile.
2	Open the File menu and click on Restore. Select the configuration file you saved when you performed the Backup operation. Click OK. EasyView displays the status of the backup. Click OK when the Restore operation is complete.
3	Open the Configure menu and click on Configure Passwords. Change the passwords from the default setting to the appropriate password for your site.
4	Open the Options menu and click on Setup Sites. Select your connection profile from the Site list. Click Modify. Change the passwords to those from the previous step. Click OK. Click Close.
5	Open the Connect menu and select Disconnect to end the EasyView session.

Memory Backup Battery Replacement for Millennium Controller

Introduction

The memory backup battery is located on the BSJ (Intelligent Controller) circuit pack. The battery provides power to retain system configuration stored in memory in the event the BSJ circuit pack is removed or input power to the Galaxy Controller is interrupted. Battery life is typically about five years.

When the memory backup battery is low, the Memory Backup Battery Low warning is active and the battery should be replaced. Perform the following three procedures to replace the memory backup battery to prevent loss of system configuration:

- Backup System Configuration
- Replace Memory Backup Battery
- Restore System Configuration

Backup System Configuration

Use the EasyView software to perform a backup of the system configuration. Refer to the discussion of EasyView in Section 4 of this manual. If you need to install EasyView for the first time, see the Product Manual "Lineage® 2000 EasyView Software for the Galaxy Controller," Select Code 193-104-105.

DANGER

Danger of explosion or fire if lithium battery is incorrectly replaced. Replace only with a battery recommended by the manufacturer. Spare batteries may be ordered per the product documentation. Lithium batteries may be regulated wastes (due to reactivity) when disposed of. Always discard used batteries according to applicable local, state, and federal regulations.

CAUTION

Lithium batteries present risk of fire, explosion, and burns. Do not recharge, disassemble, heat above 100° C (212° F), or incinerate. Dispose of used batteries promptly. Keep away from children.

Memory Backup Battery Replacement for Millennium Controller, continued

Backup System Configuration

Follow these steps to perform the backup:

Step	Action
1	Log in and begin an EasyView session.
2	Open the File menu and select Backup. Select a file name and directory to store the system configuration. Click OK. EasyView displays the status of the backup. Click OK when the Backup operation is completed.
3	If site passwords are not at default, open the Options menu and select Setup Sites. Select your connection profile from the Site list. Click Modify. Change the Administrator password to the default password “administrator.” Change the Connect password to “administrator.” Click OK. Click Close.
4	Open the Connect menu and select Disconnect to end the EasyView session.

Memory Backup Battery Replacement for Millennium Controller, continued

Replace Memory Backup Battery

Step	Action
1	Remove the memory battery. Take care not to flex the battery holder clip excessively.
2	Insert the memory battery into the BSJ (Intelligent Controller) circuit pack X201 battery holder. Observe proper polarity; the battery holder clip contacts the "+" side of the memory battery. Take care not to flex the battery holder clip excessively.

Restore System Configuration

Step	Action
1	Log in and begin an EasyView session using the previously modified connection profile.
2	Open the File menu and click on Restore. Select the configuration file you saved when you performed the Backup operation. Click OK. EasyView displays the status of the backup. Click OK when the Restore operation is complete
3	Open the Configure menu and click on Configure Passwords. Change the passwords from the default setting to the appropriate password for your site.
4	Open the Configure menu and click on System → System Time. Set the System time and date. Click OK.
5	If passwords are not at system defaults, open the Options menu and click on Setup Sites. Select your connection profile from the Site list. Click Modify. Change the passwords to those chosen for the site. Click OK. Click Close.
6	Open the Connect menu and select Disconnect to end the EasyView session.

Requirements

System

With the exception of the batteries, periodic maintenance specific to the power system is not required. The ac service for the building must be maintained with ANSI specified limits. The temperature and humidity within the power room must be maintained within the limits specified in the product manual.

Batteries

The batteries must be maintained as directed by the battery manufacturer's requirements.

Rectifiers

With the exception of a fan failure, rectifiers are repaired by replacement. Refer to "Installing or Replacing a Rectifier" in this section.

Rectifier Fan Assembly

The expected life of the rectifier fans at 25°C (77°F) is approximately eight years. The fans in the rectifiers may be replaced in the field.

Two approaches can be taken to fan maintenance:

- The first approach is to replace the fan on a routine basis every seven to eight years; this ensures that the fan does not fail in the field under normal operating conditions. This approach is appropriate when there are no remote alarm facilities at the site.

- The second approach, assuming one has remote alarm capability, is to wait until the fan fails. The rectifier will safely shut down and issue both a fail alarm and a thermal alarm. The fan can then be replaced. Since it is likely that all the rectifiers in that installation are of roughly the same age, all rectifier fans at that site should be replaced at that time.

The approach used depends on the location and manning of the site as well as the monitoring of alarms used at the site. Refer to "Replacing a Rectifier Fan Assembly" in this section.

Note: As a routine procedure, keep fan assemblies dust-free.

Requirements, continued

Converters

With the exception of a fan failure, converters are repaired by replacement.The expected life of the converter fans at 25 °C (77°F) is approximately five years. The fans in the converters may be replaced in the field.

Two approaches can be taken to fan maintenance. The first approach is to replace the two fans on a routine basis every four to five years; this ensures that the fans do not fail in the field under normal operating conditions. This approach is appropriate when there are no remote alarm facilities at the site. The second approach, assuming one has remote alarm capability, is to wait until a fan fails. It can then be replaced. Since it is likely that all the converters in that installation are of roughly the same age, all converter fans at that site should be replaced at that time. The approach used depends on the location and manning of the site as well as the monitoring of alarms used at the site. The fan replacement procedure is described in this section.

Note: As a routine procedure, keep fan assemblies dust-free.

GPS2424 Replacement Procedures

Installing or Replacing a 596B3 Rectifier

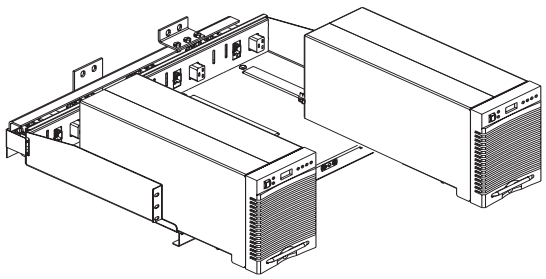
Step	Action
1	Locate and turn off the ac service feeding the rectifier. Note: Do not turn off ac service to the entire system, only to the rectifier that has failed.
2	Turn the rectifier's ON/STBY switch to STBY. **Caution** **Rear portion of the rectifier or converter that is in operation is HOT to the touch. Use appropriate precautions.**
3	(Steps 3 and 4 for replacement only. For a new installation, proceed to Step 5.) Locate the Allen-head bolt in the center of the rectifier front panel. Using the Allen wrench provided, rotate the bolt counterclockwise to release the rectifier for removal.
4	**Caution** **Handle the rectifier or converter using two hands, one hand supporting the rear of the unit, the other hand on the front handle.** Grasp the front handle and slide/pull the rectifier from the shelf assembly. Support the rear of the unit as it slides from the shelf.
	

Figure 4-1: Detail of 596B3 Rectifier Position

Continued on next page.

GPS2424 Replacement Procedures, continued

Installing or Replacing a 596B3 Rectifier, continued

Step	Action
5	Slowly slide new rectifier onto the shelf until it contacts the rear connector.
6	Using the Allen wrench, turn the Allen-head bolt clockwise to pull the rectifier into the shelf.
7	Once the rectifier has been installed, set the rectifier ID. (Refer to product manual.) Note: The red LED on the rectifier will blink until the rectifier establishes communication with the controller. After communication is established, the controller will issue a RECT MAJ alarm until the rectifier ID is set.
8	Turn the ac service back on.
9	Turn the rectifier's ON/STBY switch to ON.

GPS2424 Replacement Procedures, continued

Replacing a 596B3 Rectifier Fan Assembly

Stop! Review the "Installing or Replacing a Rectifier" procedure in this section before proceeding.

Step	Action
1	Remove the rectifier from the system. See the "Installing or Replacing a Rectifier" procedure in this section.
2	WAIT five minutes for capacitors to discharge.
3	Loosen the white front cover by removing 14 screws (5 top, 5 bottom, 2 on each side). Before fully removing the cover, disconnect the ribbon cable from the display circuit pack.
4	Remove the screws attaching the old fans to the chassis and carefully unplug the fan connector. The fan connector is keyed and can be loosened by inserting a screwdriver into the slotted side of the connector and gently prying the fan-side connector loose.
5	Replace the new fans.
6	Reconnect the ribbon cable removed in Step 3.
7	Attach the front cover.
8	Install the rectifier, following instructions in the "Installing or Replacing a Rectifier" procedure in this section.

5 Glossary

Please turn to the following pages for glossary terms related to the SC, SCF, and Millennium Controllers.

SC Controller Circuit Boards (Basic)

BJA1 or BJA2 Power Board	Provides the power required by the basic controller, and provides the hardware high voltage (HV) circuitry. BJA1 is for 48 volt systems; BJA2 is for 24 volt systems.
BJB1 Digital Board	Contains the microprocessor, memory, serial interface, chip select logic, and other digital components used for the basic controller.
BJC1, BJC2 or BJC3 Rectifier Interface Boards	BJC1 provides the circuitry to interface with Lineage Power rectifiers with VI signals, ferroresonant, or switch mode rectifiers (without rectifier current monitoring). BJC2 provides the same functions for rectifiers with mV shunt signals: Lineage Power switch mode and non-Lucent rectifiers. Each board can control up to eight rectifiers, allowing Galaxy to control a total of 24 rectifiers. BJC3 (Serial Rectifier Interface Board) provides the circuitry to interface with Galaxy serial interface switchmode rectifiers and converters. The BJC3 can control up to 24 serial rectifiers or converters.
BJE1 Relay/Alarm/ Display Driver Board	Contains the remaining circuitry required by the basic controller. Has isolation circuits to receive contact closures from other parts of the plant such as external fuse alarms, TR leads, and external timer float and boost leads. Contains the alarm relays such as power major and power minor. Also contains the interface circuits to the front panel display board (BJG1).
BJF1 or BJF2 Termination Fuse Board	Contains the input power terminal blocks and fuses for the controller. BJF1 is for negative voltage plants; BJF2 is for positive voltage plants.
BJG1 Display Board	Contains the switches, LEDs and eight-line display for the front panel, providing the primary user interface for the controller. Mounted inside the front door
BJT1 Termination Board	Contains the terminal blocks for customer alarm wiring and signal inputs. This board mounts next to the backplane on the back of the controller.

SC Controller Circuit Boards (Intelligent)

BJH Intelligent Controller Board	Contains the microprocessor, memory, real time clock, serial interface, and interface circuitry to the other intelligent circuit packs. Enables "intelligent" features, including alarm history, battery reserve time prediction, peripheral monitor and control, etc. Also provides access to the TL1/X.25 interface.
BJJ1 or BJJ2 Power Boards	Provides power to the intelligent controller board and intelligent option boards. BJJ1 is for 48 volt systems; BJJ2 is for 24 volt systems.
BJK1 Data Switch	Operates the Data Switch, an optional interface with XCS, ECS, RAS, and OMNIpulse units. Data Switch allows call-in and call-out access to as many as four RS-232 devices via the Galaxy access ports.
BJL2 Modem Board	Required for data access over telephone lines. Provides the modem circuitry needed to interface the controller from a remote location over the switched telephone network at up to 14,400 baud.
BJM1 Peripheral Monitoring Board	Required for any peripheral monitoring or control. Provides interface circuitry for up to 255 remote monitoring modules, allowing connections to as many as 1,530 monitoring points.

SCF Controller Circuit Boards

The following figure shows the location of the Basic and Intelligent circuit boards in the SCF Controller, which are described in the following pages.

SCF Controller Boards (Basic)

BJA1 or BJA2 Basic Controller Power Board	This board provides the power required by the basic controller. BJA1 is for 48-volt systems, BJA2 is for 24-volt systems.
BJB1 Basic Controller Digital Board	The BJB1contains the microprocessor, memory, serial interface, and other digital and analog components used for the basic controller.
BJC3 Serial Rectifier Interface Board	BJC3 provides the circuitry to interface with Galaxy serial interface switchmode rectifiers and converters. The BJC3 can control up to twenty-four serial rectifiers and 8 converters.
BJE2 Relay/Alarm/ Display Driver Board	Contains the remaining support circuitry required by the basic controller. Has isolation circuits that receive contact closures from other parts of the plant such as external fuse alarms, TR leads, and external timer float and boost leads. Also contains the alarm output relays such as power major and power minor. Provides the interface circuits to the front panel display board (BJG1). Also contains Form-C contacts that may be used for external contactor control.
BJF3 or BJF4 Termination Fuse Board	Contains the input power terminal blocks and fuses for the controller. BJF3 is for negative voltage plants; BJF4 is for positive voltage plants.
BLG1 Front Access Board	Mounts above the rest of the circuit packs internal to the chassis. Provides front access connections to all the customer's alarm wiring and signaling inputs.
BJG1 Display Board	Mounted inside the front door. Contains the switches, LEDs, and the eight-line display control for the front panel, providing the primary user interface for the controller. The display is protected by a lexan cover to protect against high levels of electrostatic discharge (ESD).

SCF Controller Circuit Boards (Intelligent)

BJJ1 or BJJ2 Intelligent Controller Power Boards	Required for any intelligent features. Provides power to the intelligent controller board and intelligent option boards. BJJ1 is for 48 volt systems; BJJ2 is for 24 volt systems.
BJH Intelligent Controller Board	Required for all the intelligent functions of the Galaxy SCF Controller. Contains the microprocessor, memory, real time clock, various serial interfaces, and interface circuitry to the other intelligent circuit packs. Enables "intelligent" features, including alarm history, battery reserve time prediction, peripheral monitoring and control, etc. Also provides access to the TL1/X.25 interface.
BJL2 Modem Board	Required for data access over telephone lines. Provides the modem circuitry needed to interface the controller from a remote location over the switched telephone network at up to 14,400 baud.
BJM1 Peripheral Monitoring Board	Required for any peripheral monitoring or control. Provides interface circuitry for up to 255 remote monitoring modules, allowing connections to as many as 1,530 monitoring points.
BJK1 Data Switch	Required to operate the Data Switch, an optional interface with XCS, ECS, RAS, and OMNIpulse units. Data Switch allows call-in and call-out access to as many as four RS-232 devices via the Galaxy access ports.

Millennium Controller Boards (Basic)

BSH1 or BSH2 Basic Controller Digital Board	Contains the microprocessor, memory, serial interface, and other digital and analog components used for the Basic controller. Communicates over an isolated serial data link to the GPS Bay Interface Card to control rectifiers, converters, manage low voltage disconnect contactors, and bay level alarm inputs. BSH1 is for -48V systems; BSH2 is for +24V systems.
BSK1 LCD Display/Keypad, LED Board	Mounted in a shallow enclosure on the front door of the power plant. Contains the keypad switches, LEDs, and the eight-line LCD display for the front panel, which provides the primary user interface for the controller. Mounted on the BSH Basic Controller board.
BSL1 or BSL2 Alarm Termination Board	Provides connection points to interface external controller input signals and alarm outputs to the customer alarm system. BSL1 provides for wire wrapped connections; BSL2 provides for insulation displacement connections.

Millennium Controller Circuit Boards (Intelligent)

BSJ1 or BSJ2 Intelligent Controller Board	Required for all the intelligent functions of the Galaxy Millennium Controller. Contains the microprocessor, memory, real time clock, various serial interfaces, and interface circuitry to the other intelligent circuit packs. Enables "intelligent" features, including alarm history, battery reserve time prediction, TL1/X.25 interface, peripheral monitoring and control, etc. BSJ1 is for 48V systems; BSJ2 is for 24V systems.
BSM1 Modem Board	Required for data access over telephone lines. Provides the modem circuitry needed to interface either the Basic or Intelligent controller from a remote location over the switched telephone network at up to 14,400 baud.
BSW1 Data Switch Extension Board	Provide an optional interface with XCS, ECS, Galaxy, RAS, and OMNIpulse units. Data Switch allows call-in and call-out access to as many as six RS-232 devices via the Galaxy access ports.